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STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

INSTRUMENTATION

FOR BOX GIRDER TESTS

HARRISON STREET UNDERCROSSING

62-18
DND

NOVEMBER 1962

MATERIALS & RESEARCH DEPARTMENT
SAGACITAS - SCIENTIA - STVDIVM

State of California
Department of Public Works
Division of Highways
Materials and Research Department

November 1962

Laboratory Project
Auth. 100--R--6200

Mr. James E. McMahon
Assistant State Highway Engineer, Bridges
California Division of Highways
Sacramento, California

Attention: Mr. John J. Kozak

Dear Sir:

Submitted for your consideration is a report of:

INSTRUMENTATION FOR BOX GIRDER TESTS

HARRISON STREET UNDERCROSSING

Instrumentation performed by . . . Structural Materials Section
Under direction of . . . . . J. L. Beaton
Work supervised by . . . . . J. E. Barton and W. Chow
Report prepared by . . . . . W. Chow

Very truly yours,

F. N. Hveem
Materials and Research Engineer

By
J. L. Beaton
Asst. Materials and Research Engineer

JLB/JEB/WC:mw

…ly yours,

…Research Engineer

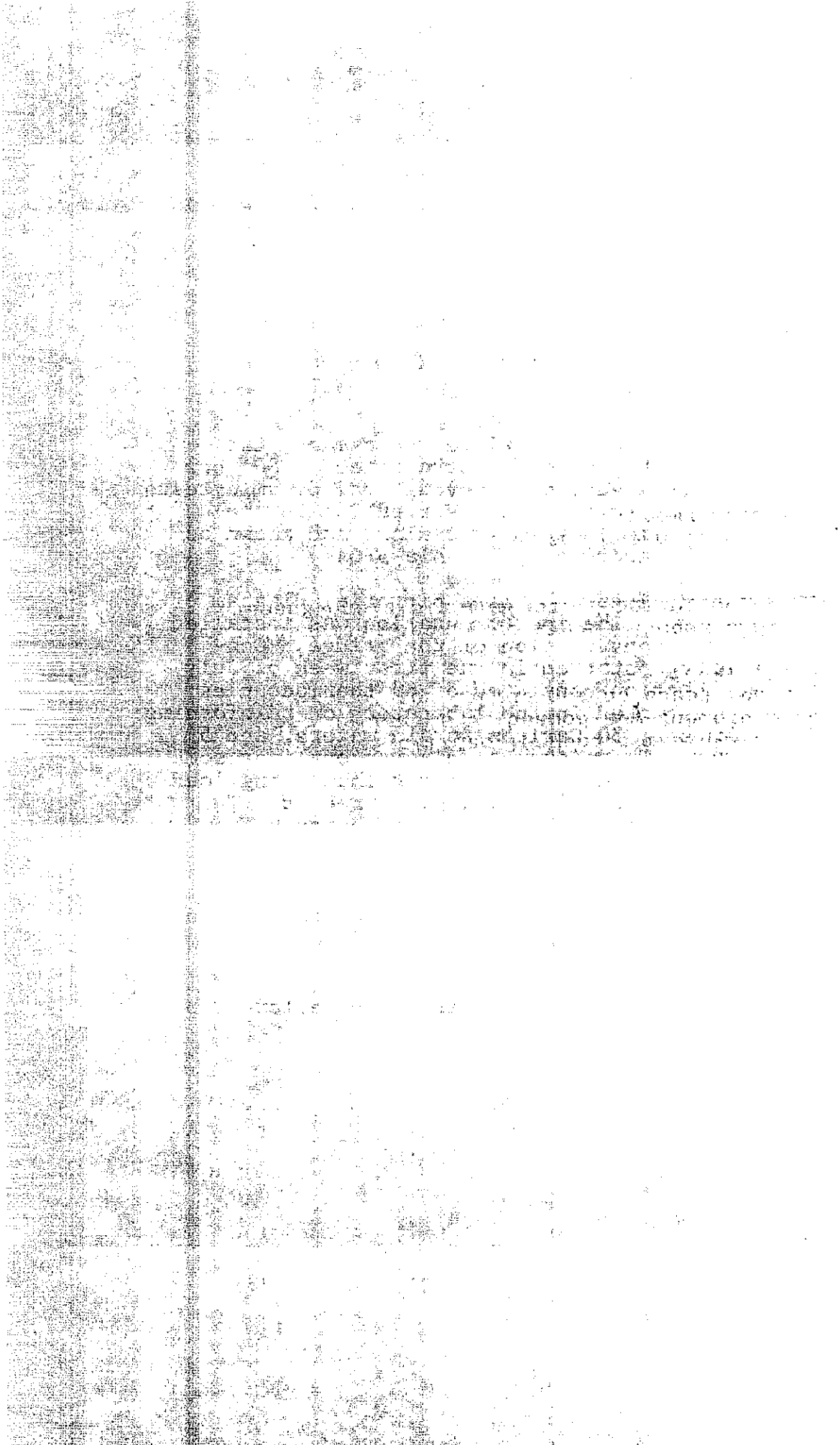
INTRODUCTION

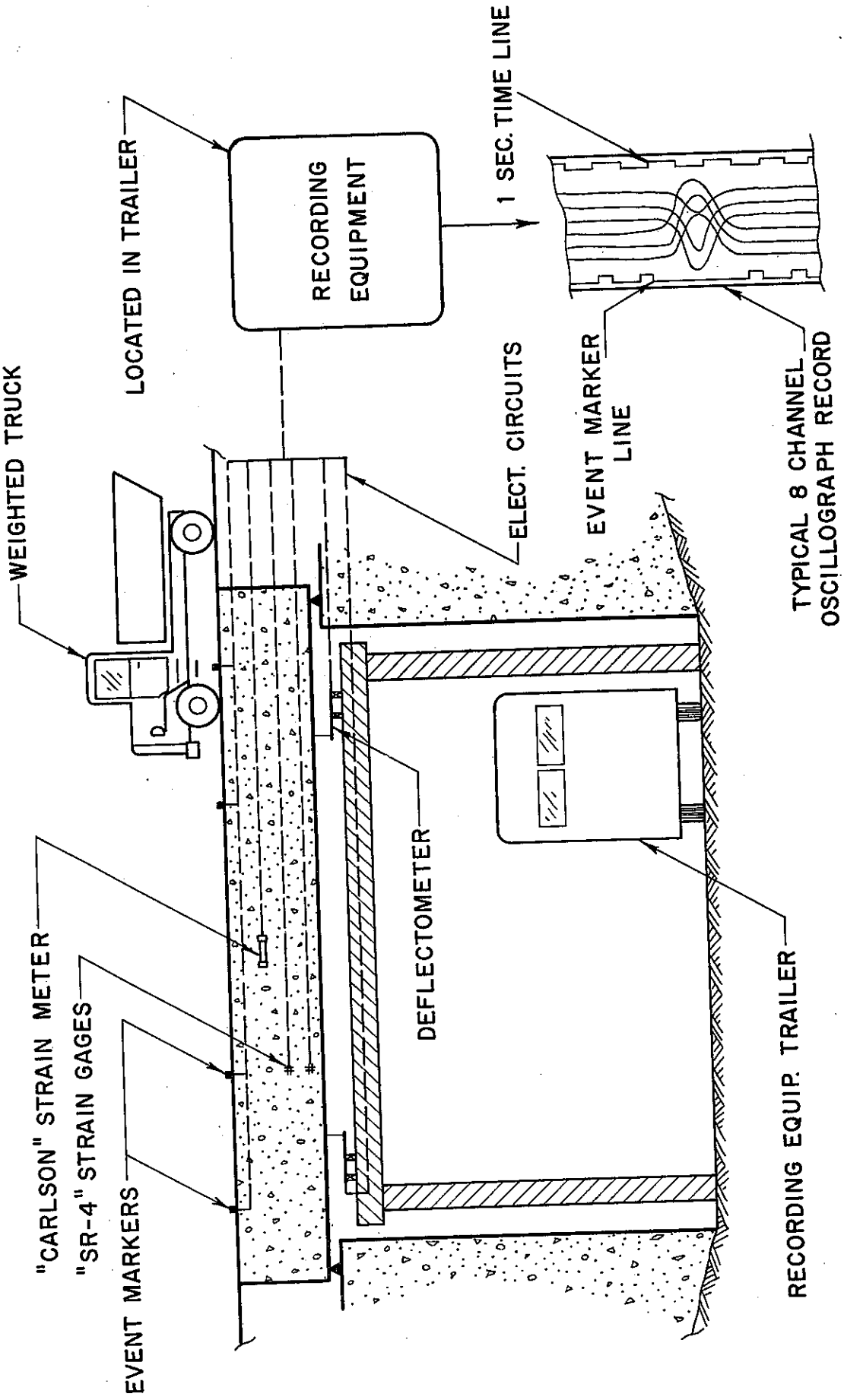
At the request of the Bridge Department, the Materials and Research Department instrumented an 80' box girder type bridge for a series of moving load dynamic tests and static tests to determine load distribution in the structure. The bridge is located in Oakland and known as the Harrison Street Undercrossing, IV-Ala-5-Oak.

The drawing, Figure 1, is a pictorial diagram of the dynamic test setup. The instrumentation was installed concurrently with the construction of the bridge. Construction of the bridge started in the first week of July 1960. The instrumentation consisted of 69 thermocouples, 158 strain gages premounted in the laboratory on reinforcing bars, 22 deflectometers, 30 Carlson strain meters, and 5 rosette strain gages. The pictorial diagram outlines some of the instrumentation, the truck used for the moving load tests, and a typical 8 channel oscillograph record. The recording equipment was housed in a trailer beneath the bridge. Final tests on the bridge were completed on December 10, 1960.

This report covers only the instrumentation and recording as performed by the Materials and Research Department.

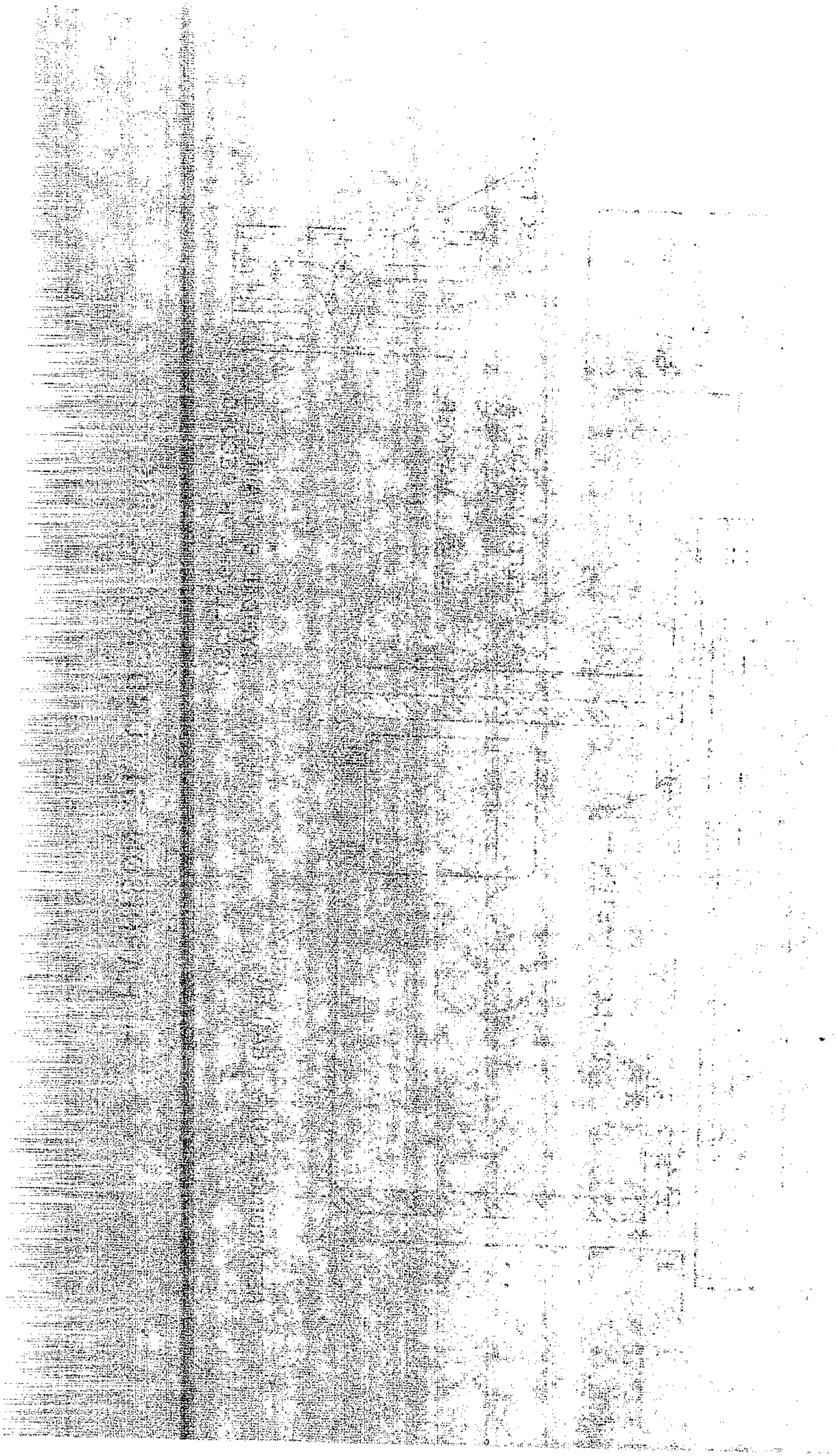
Reduction and analysis of data were performed by the Bridge Department.





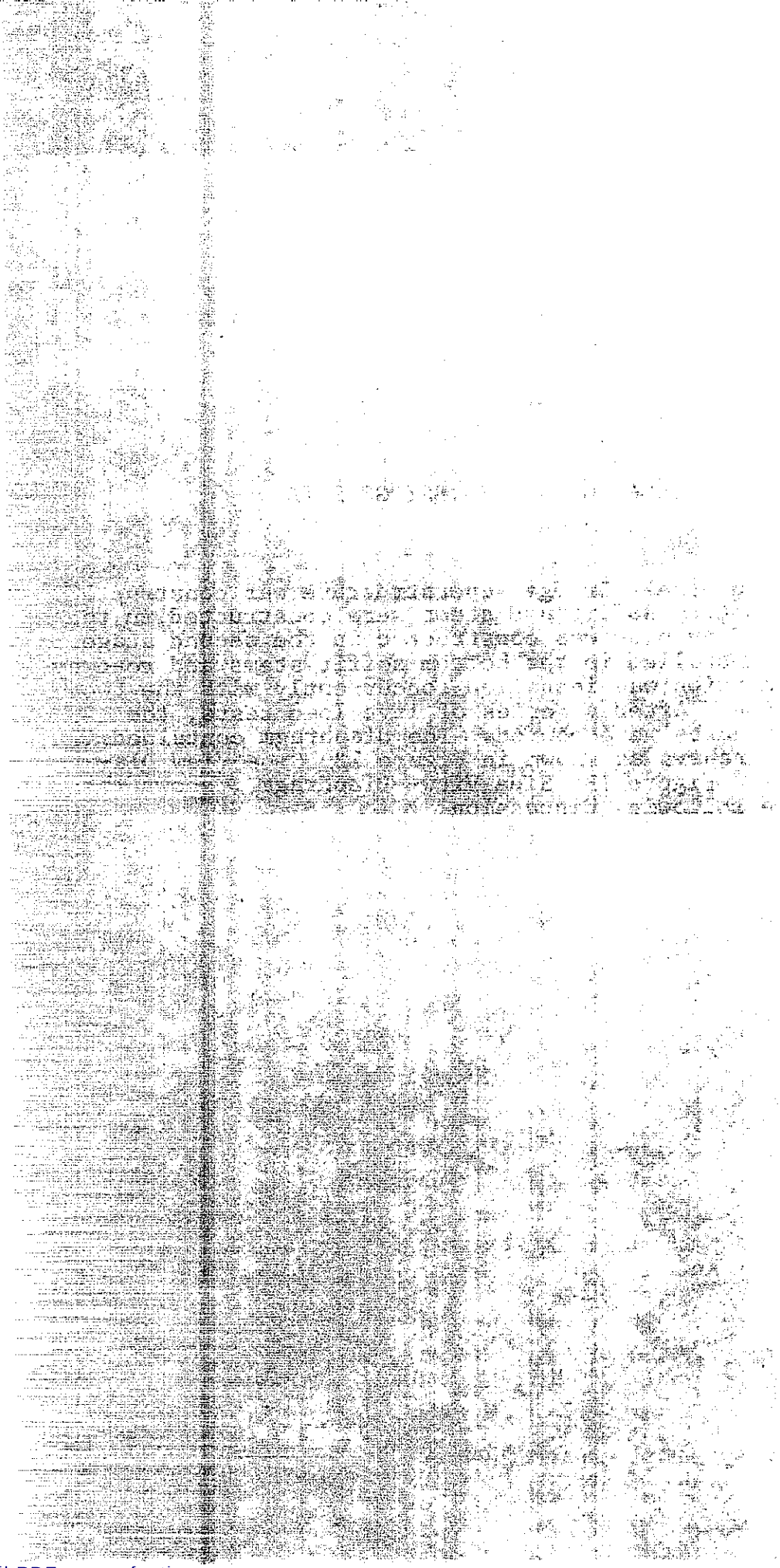
— HARRISON ST. UNDERCROSSING —

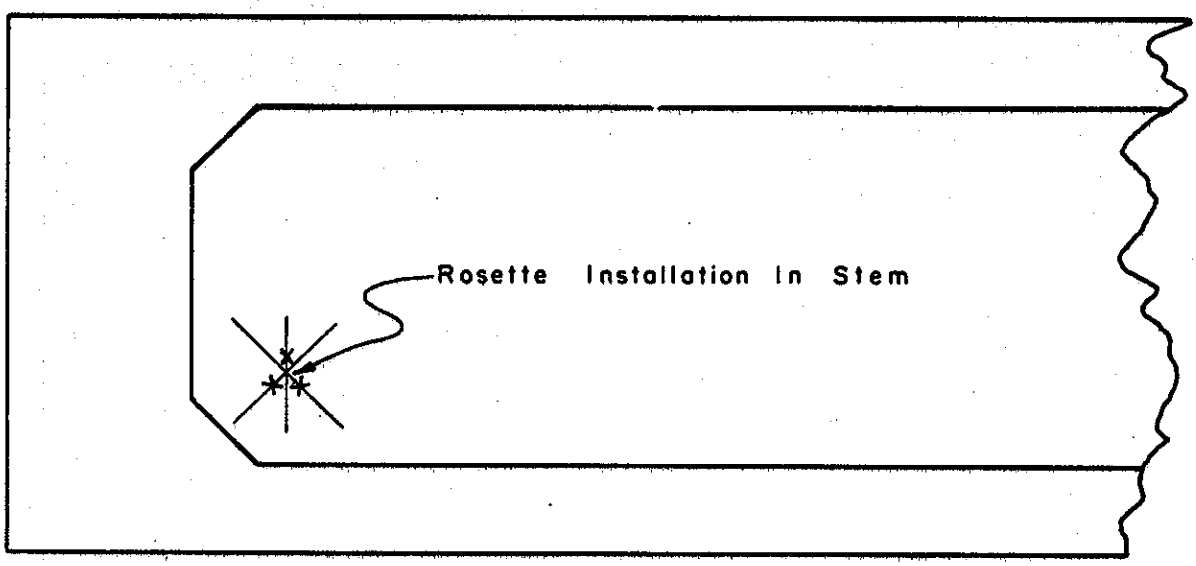
FIG. 1



INSTRUMENT INSTALLATION AT THE BRIDGE SITE

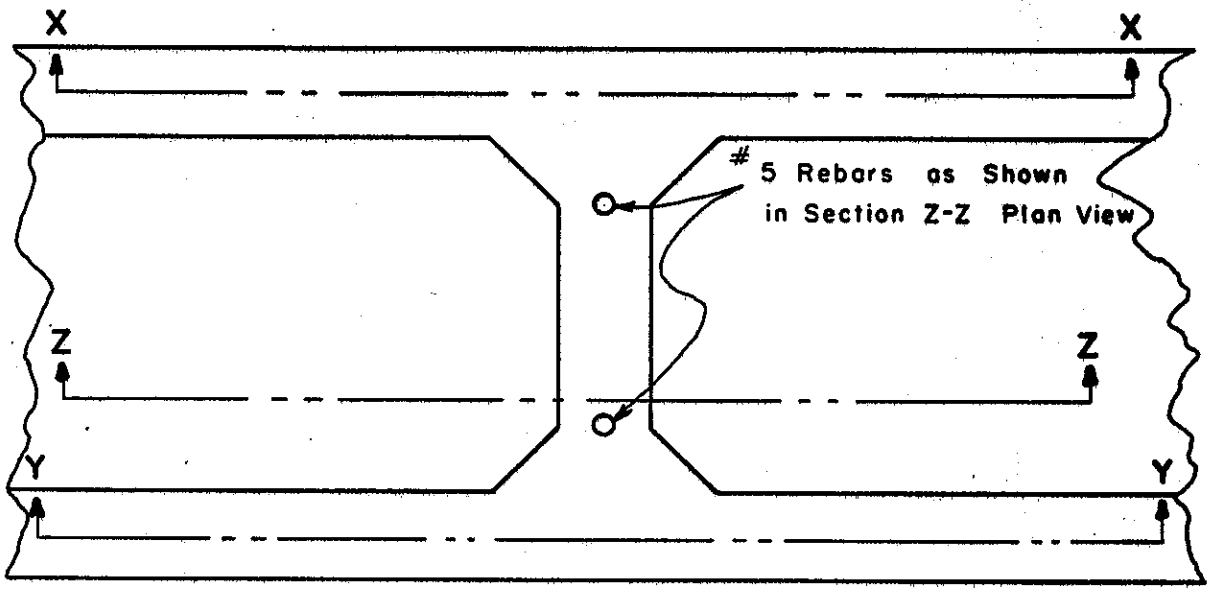
The Harrison Street Bridge superstructure was constructed in two stages. The bottom soffit and stems were constructed in the first stage. The roadway slab was constructed in the second stage. Instrumentation was installed in the bottom soffit stems and roadway slab. The instrumentation was installed concurrently with the two stages of construction. After a series of live load tests, the center diaphragm and curbs were poured. The diaphragm contained four strain gaged #5 rebars as shown in Figure 1B, Side View Diaphragm, and Figure 4. Figure 1B, Side View--Diaphragm , shows the X-Y-Z- planes of the following discussion.





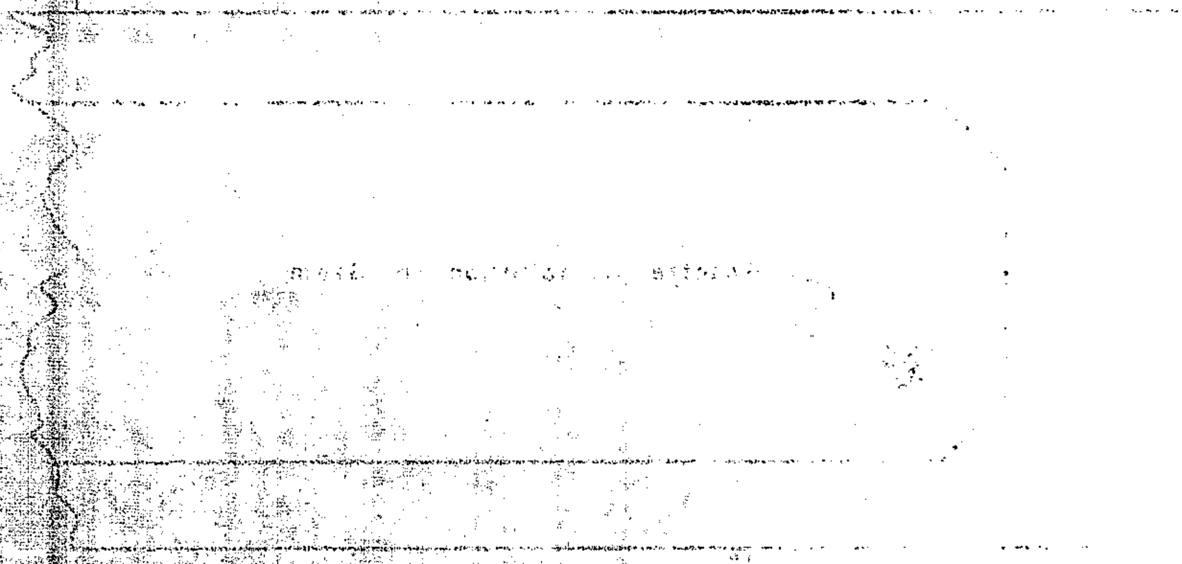
SIDE VIEW – End Section

FIG. 1A



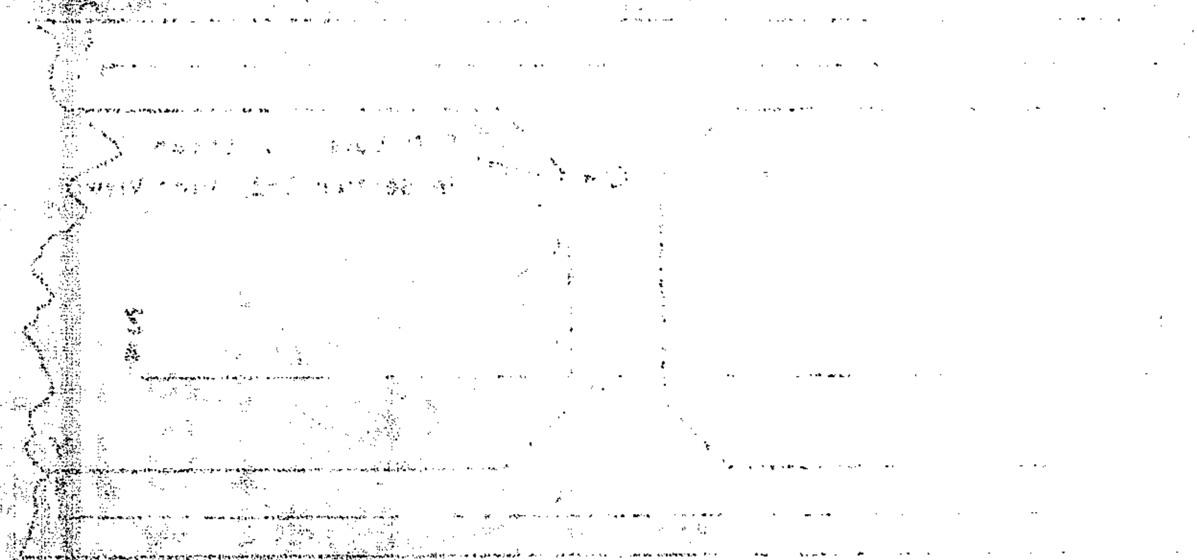
SIDE VIEW – Diaphragm

FIG. 1B



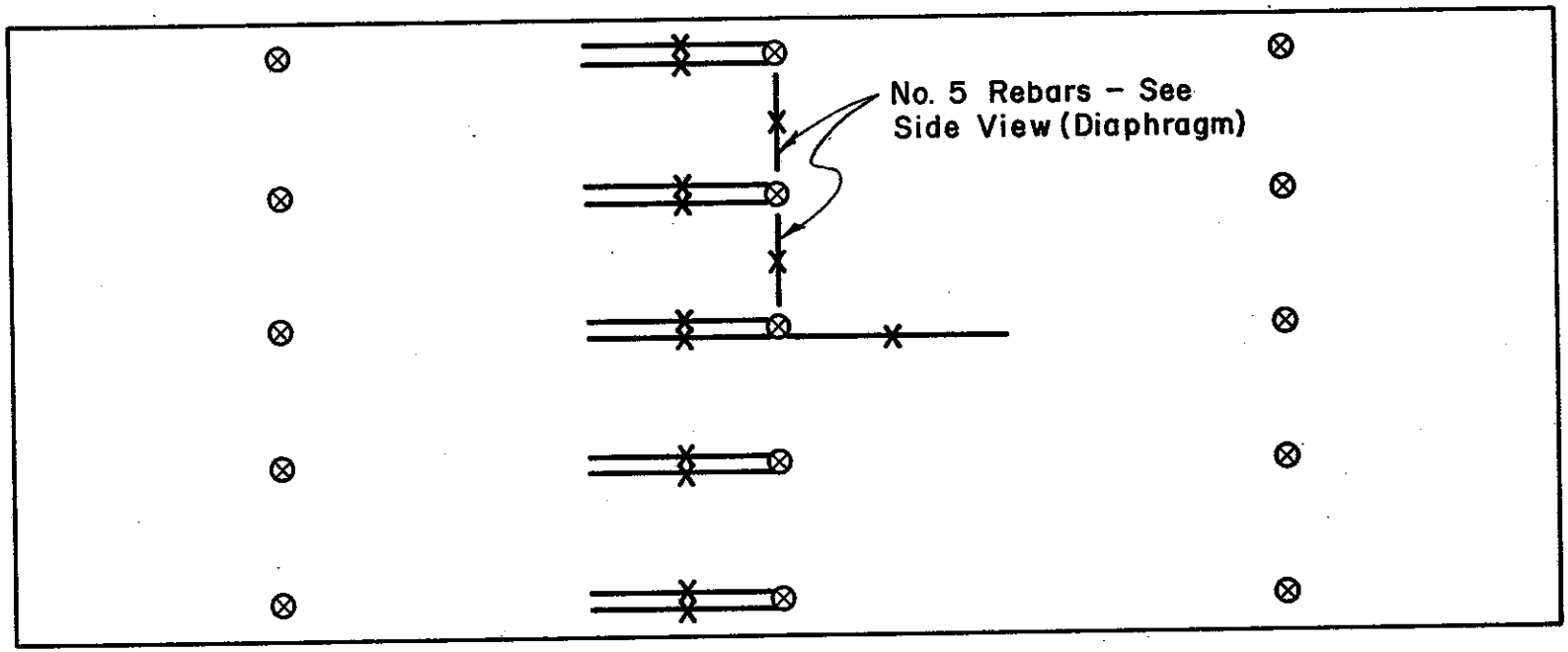
Side View - End Section

Fig. 1A



Side View - Diaphragm

Fig. 1B



LEGEND

⊗ – Thermocouples

X – Strain Gage

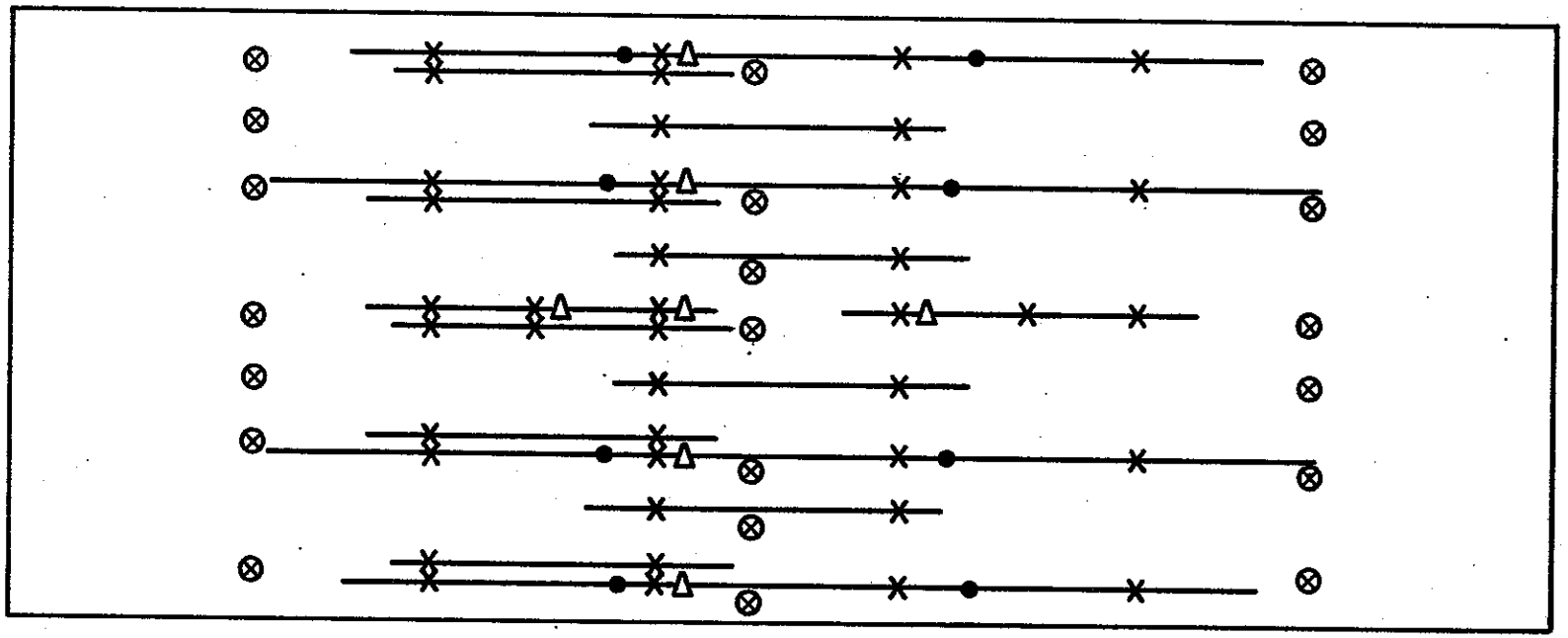
NOTES:

All bars shown are No. 5 Rebars.

SECTION Z-Z

PLAN VIEW – LOWER 1/3 POINT

FIG. 2



LEGEND

⊗ – Thermocouple (Top of Slab)

X – Strain Gage

● – Weld

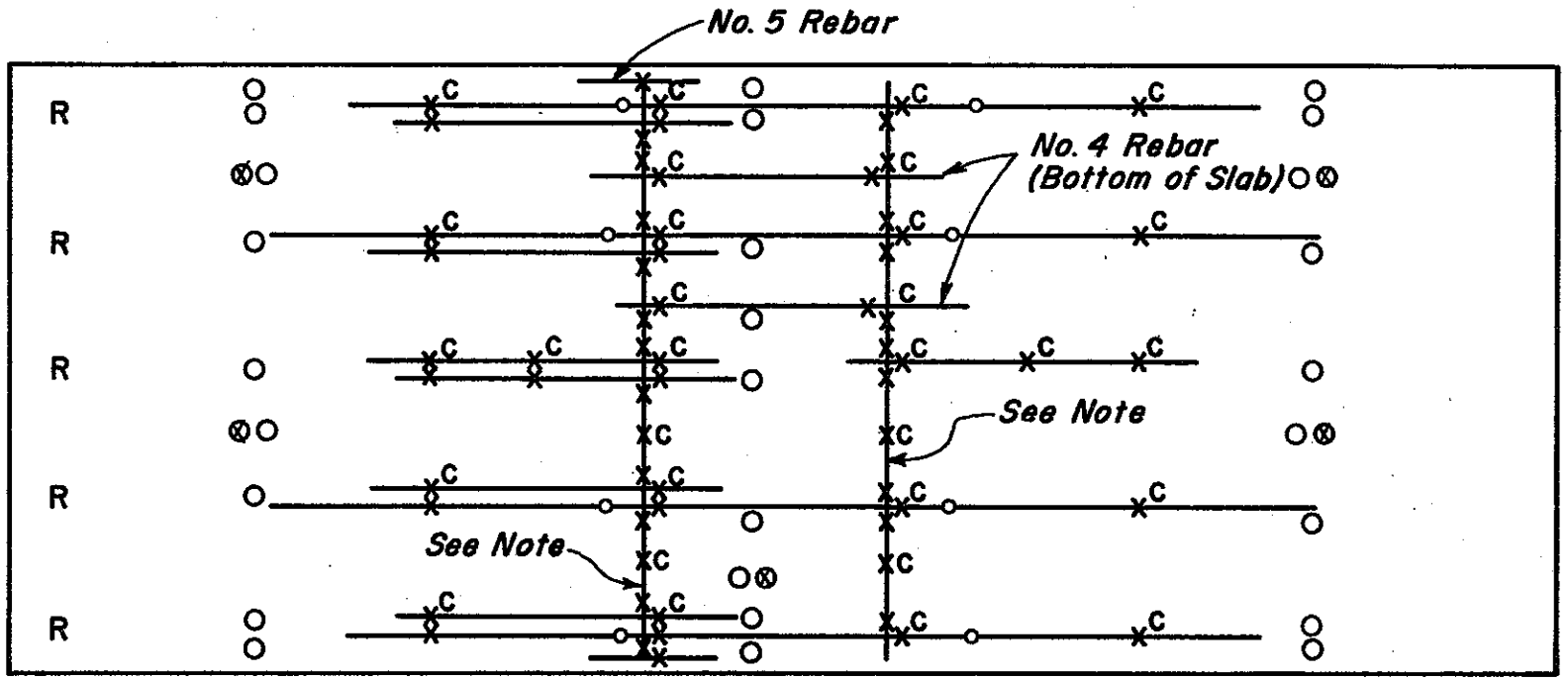
Δ – Whittemore Gage (Boxed out during pour)

—— No. 11 Rebar (Unless otherwise noted)

SECTION Y-Y

PLAN VIEW – BOTTOM SOFFIT

FIG. 3



No. 5 Rebar

NOTE: No. 5 Transverse Rebar – 2 Identical (1 Top & 1 Bottom of Roadway Surface Slab).

LEGEND

- O – Thermocouple (Bottom of Slab)
- ⊗ – Thermocouple (Top of Slab)
- X – Strain Gage
- o – Weld
- C – Carlson Strain Meter
- R – Rosette Installation (See Side View, End Section)
- —— No. 11 Rebars (Unless Otherwise Noted)

SECTION X X

PLAN VIEW – ROADWAY SURFACE

FIG. 4

The concrete bottom soffit and stems were poured in one unit. Figure 2 is a plan view of bottom soffit instrumentation. Only strain gaged reinforcing bars are shown throughout in these plans. For simplicity and clarity, the remainder of the reinforcement is not shown.

After the soffit stem concrete had cured, the top roadway surface was placed. Figure 3 is a plan view of roadway surface instrumentation. Figure 4 is a plan view of the thermocouple and strain gage instrumentation in the stems at the lower 1/3 point and four strain gaged locations in the diaphragm. Side view -- end section of Figure 1A shows the rosette installation. There are five rosette installations.

The #11 and #5 reinforcing bars that had been "strain gaged" at the laboratory replaced directly a portion of the normal bridge reinforcing bar installation. The total weight of #11 bars replaced was 5143 pounds and the total weight of #5 bars replaced was 532 pounds. Figure 5 shows the fabrication of the bottom soffit steel mat on the bottom forms. The welder is welding the strain gaged #11 reinforcing bar to the regular #11 bar. This will form a continuous length of #11 reinforcing bar sufficient to span the length of the bridge.

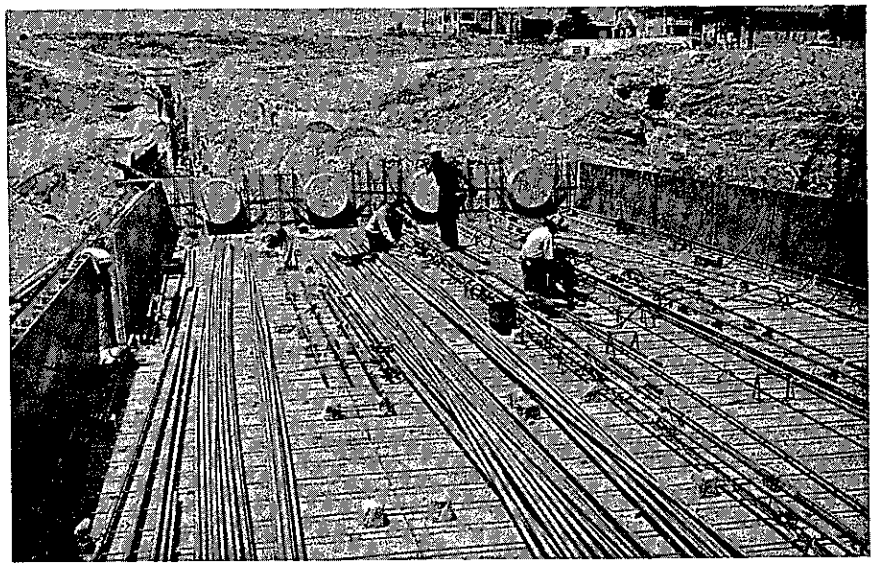
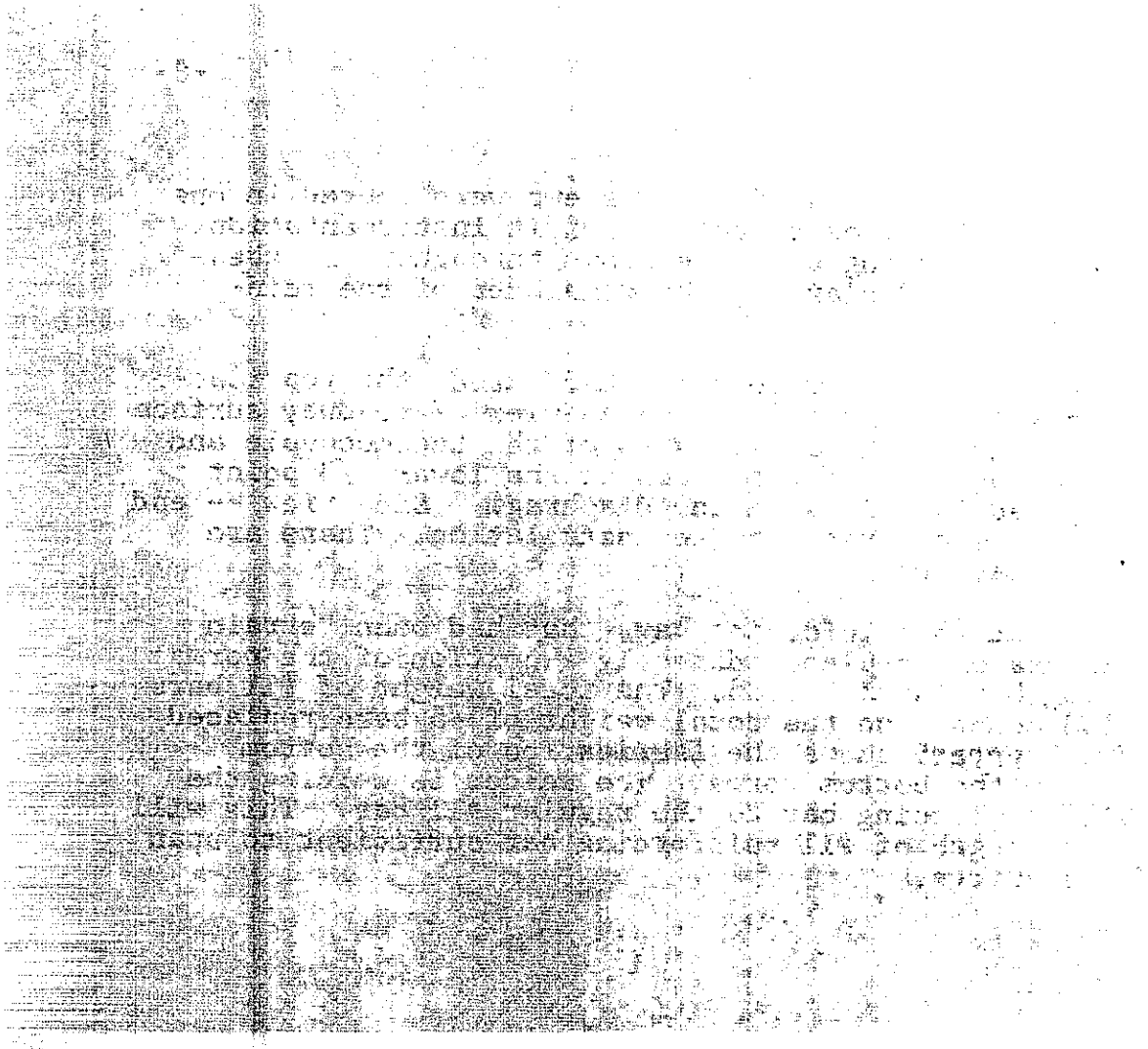


Figure 5



A view of the joints prepared for welding the #11 reinforcing bar being placed together prior to welding is shown in Figure 6.

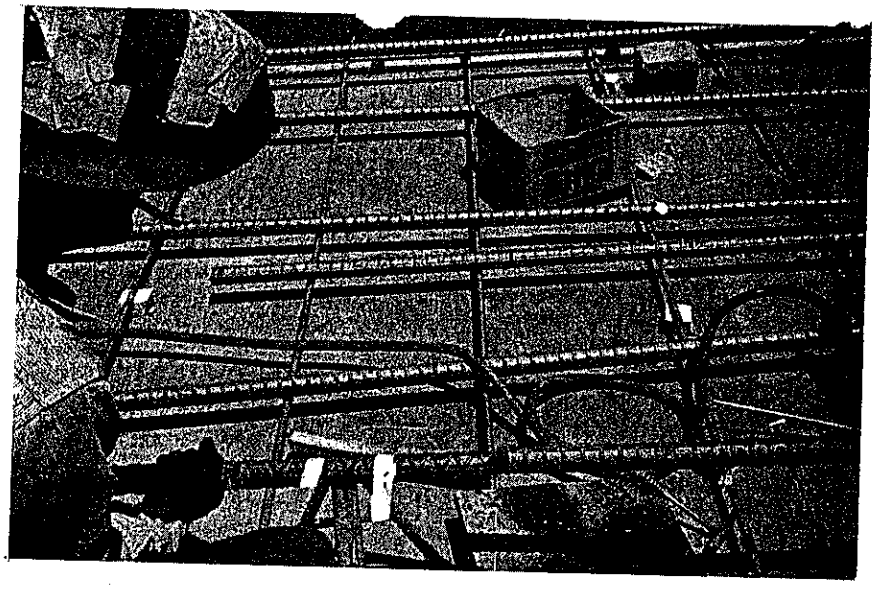


Figure 6

Figure 7 is a view of two #11 bars butt welded together. A total of 23 lengths of #11 bar with a total of 41 strain gaged locations was thus placed in the bottom soffit. All welds of the #11 bars were radiographed for soundness of weld.

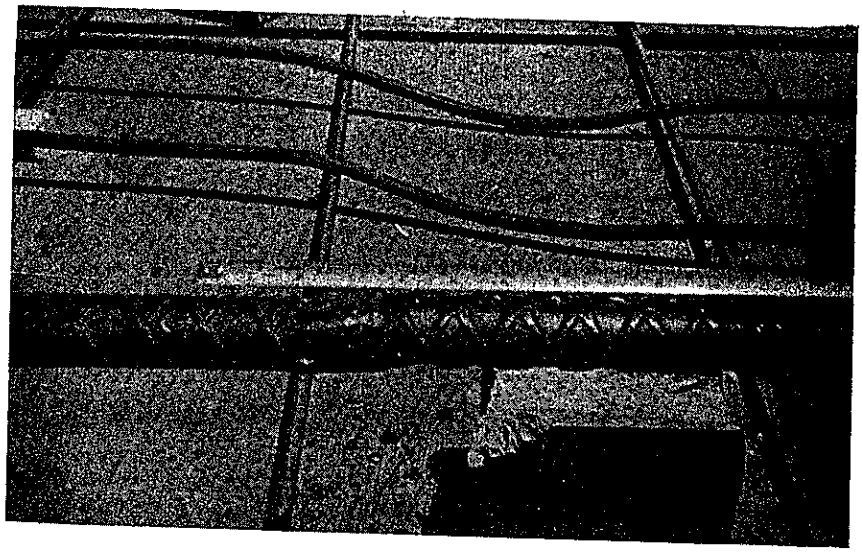


Figure 7

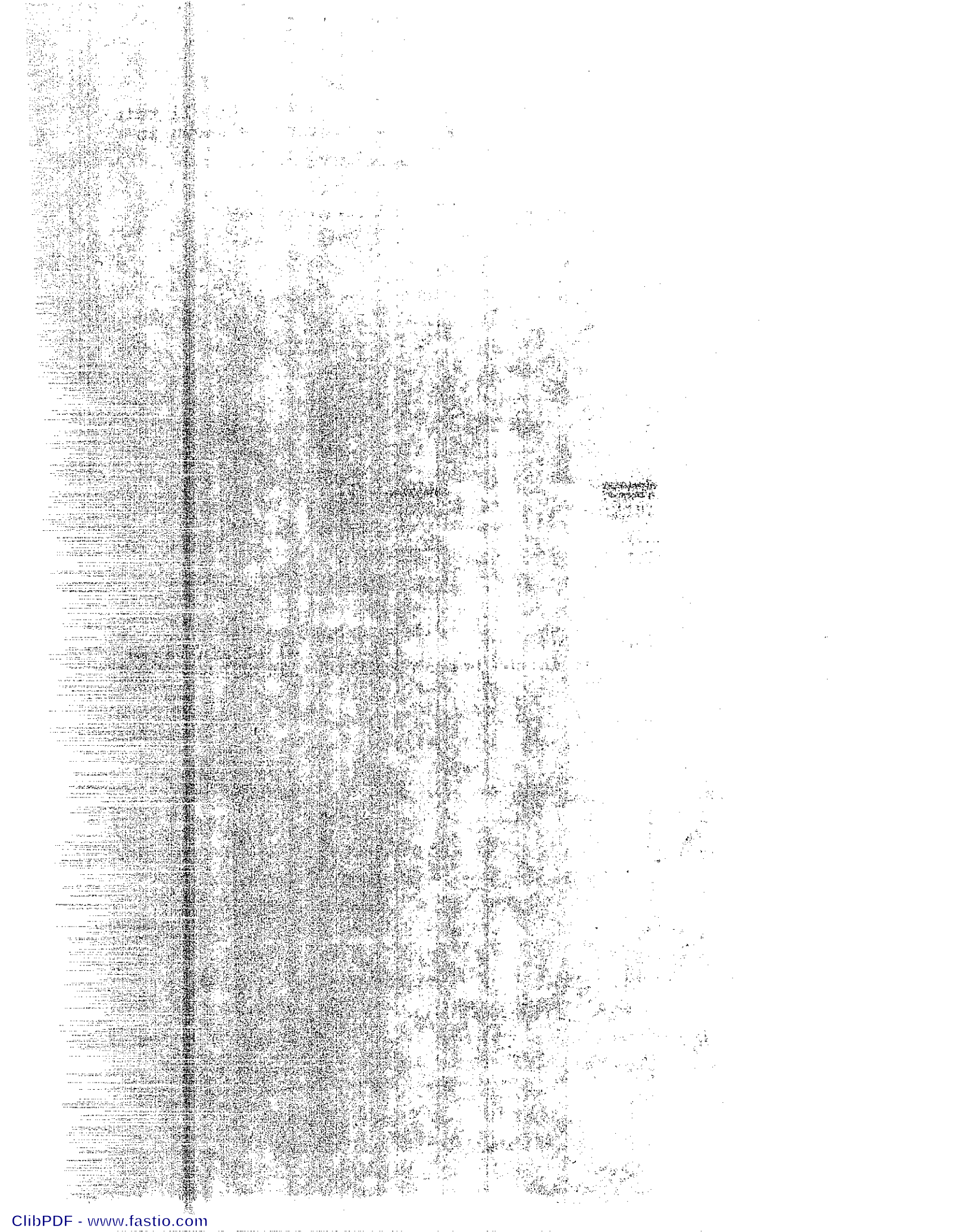


Figure 8 is a view of the bottom steel mat and stems.

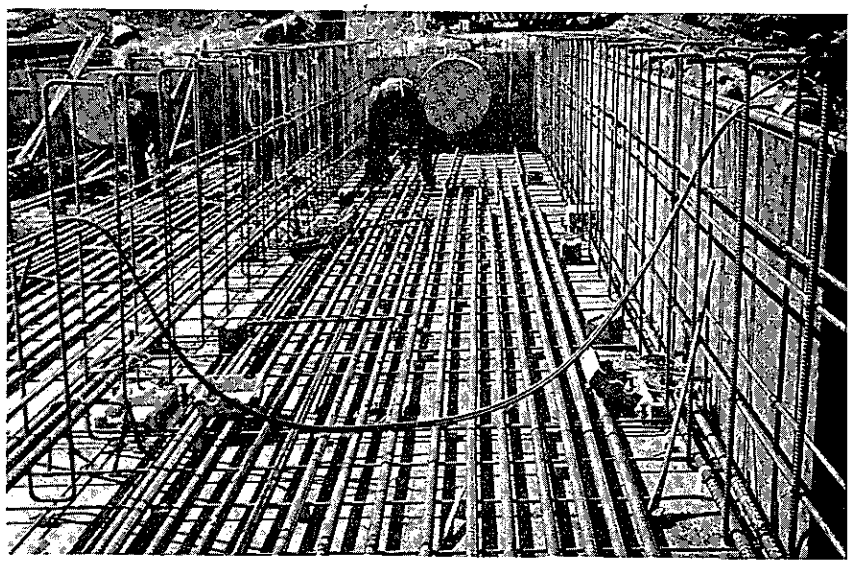


Figure 8

All of the gaged locations of the bottom #11 bars were boxed during construction so that they would be accessible from the exterior bottom of the bridge.

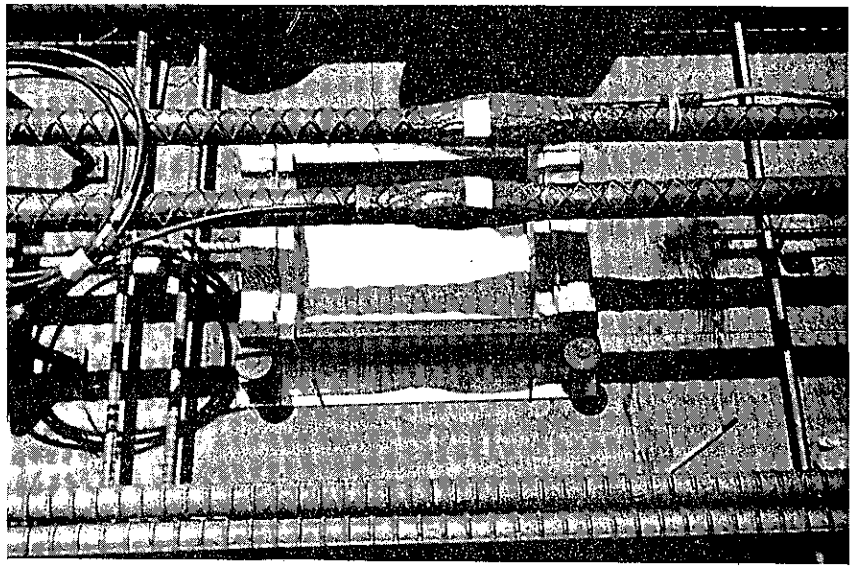


Figure 9